

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
4 August 2005 (04.08.2005)

PCT

(10) International Publication Number  
**WO 2005/071752 A1**

(51) International Patent Classification<sup>7</sup>: **H01L 29/00**

(21) International Application Number:  
PCT/US2004/000908

(22) International Filing Date: 14 January 2004 (14.01.2004)

(25) Filing Language: English

(26) Publication Language: English

(71) Applicant (for all designated States except US): **INTERNATIONAL BUSINESS MACHINES CORPORATION** [US/US]; New Orchard Road, Armonk, NY 10504 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **ANGYAL, Matthew** [US/US]; 33 Honeysuckle Court, Stormville, NY 12582 (US). **HICHRI, Habib** [TN/US]; 3E Canterbury Lane, Wappingers Falls, NY 12590 (US). **LEE, Jia** [US/US]; Nine Wolden Road, Apartment 10, Ossining, NY 10562 (US). **MCHERRON, Dale** [US/US]; Rural Route One,

Box 290C, Staatsburg, NY 12580 (US). **NYE, Henry, A., III** [US/US]; 196 Whisconier Road, Brookfield, CT 06804 (US).

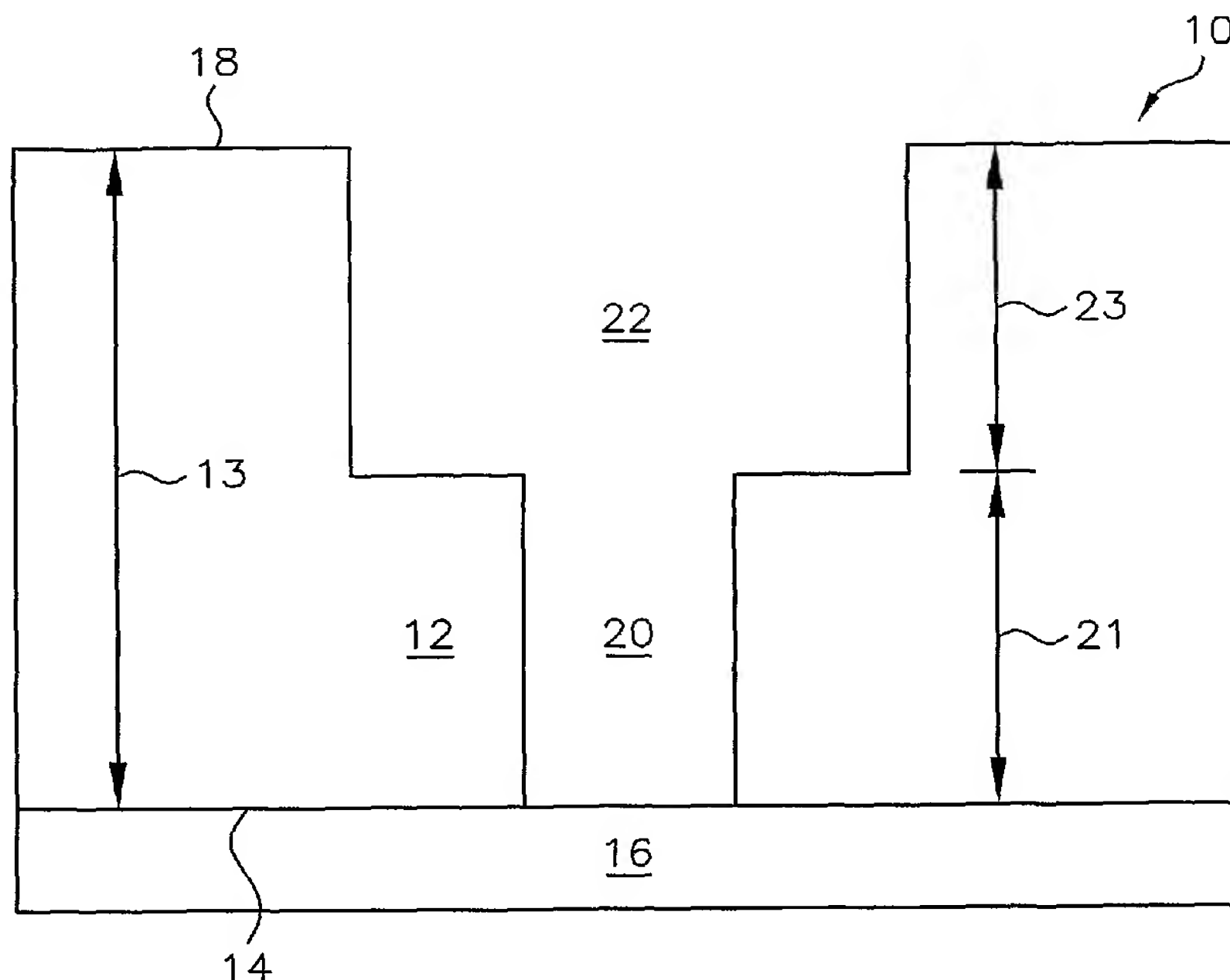
(74) Agent: **CASEY, Kevin, R.**; RatnerPrestia, P.O. Box 980, Valley Forge, PA 19482 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR,

[Continued on next page]

(54) Title: GRADIENT DEPOSITION OF LOW-K CVD MATERIALS



(57) Abstract: A dielectric layer (12) for a semiconductor device having a low overall dielectric constant, good adhesion to the semiconductor substrate, and good resistance to cracking due to thermal cycling. The dielectric layer (12) is made by a process involving continuous variation of dielectric material deposition conditions to provide a dielectric layer having a gradient of dielectric constant.

WO 2005/071752 A1



GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**

— *with international search report*

**Declaration under Rule 4.17:**

— *of inventorship (Rule 4.17(iv)) for US only*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*